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Vibration Sideband Modulations and Harmonics Separation of a Planetary Helicopter Gearbox with Two Different Configurations
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Abstract

This paper examines the spectrum and cepstrum content of vibration signals taken from a helicopter gearbox with two different configurations (3 and 4 planets). It presents a signal processing algorithm to separate synchronous and nonsynchronous components for complete shafts' harmonic extraction and removal. The spectrum and cepstrum of the vibration signal for two configurations are firstly analyzed and discussed. The effect of changing the number of planets on the fundamental gear mesh frequency (epicyclic mesh frequency) and its sidebands is discussed. The paper explains the differences between the two configurations and discusses, in particular, the asymmetry of the modulation sidebands about the epicyclic mesh frequency in the 4 planets arrangement. Finally a separation algorithm, which is based on resampling the order-tracked signal to have an integer number of samples per revolution for a specific shaft, is proposed for a complete removal of the shafts harmonics. The results obtained from the presented separation algorithms are compared to other separation schemes such as discrete random separation (DRS) and time synchronous averaging (TSA) with clear improvements and better results. © 2016 Nader Sawalhi.

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